AMENDMENTS TO THE SPECIFICATION

Please amend the paragraph on page 13, line 13, to page 14, line 14, as follows:

The receiver 204 includes an input notch filter 212 that receives the transmitted signal from the receive coupler 203 and that is coupled to the protocol processor 206 and receives the frequency data therefrom. The notch filter 212 is designed to provide a passband that includes the uphole communications signal frequency but blocks the frequency of the unmodulated downhole power signal. In one embodiment, the notch filter provides 80 dB of attenuation to the power signal carrier frequency. Accordingly, the notch filter is responsive to a frequency command received from the protocol processor 206 and adjusts the center frequency of the notch to correspond to the selected ~~uphole~~ downhole communications signal frequency. The notch filter 212 provides the notch-filtered signal to a lowpass and a highpass filter 214 and 216 respectively. The lowpass filter 212 and highpass filter 214 together form a bandpass filter that has a passband that corresponds to the carrier signals used in the uphole communications signal provided by the downhole modem. The filtered signal is then provided to a variable gain amplifier 218 that is coupled to the protocol processor 206. The protocol

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processor adjusts the gain of the amplifier as discussed above. The filtered and amplified signal is then provided to the receive DSP 222 via A/D converter 222A, which is preferably an eight-bit analog to digital converter. The receive DSP 222 performs the required functions that are required for demodulation of the particular modulation scheme. Such functions may include without limitation, packet synchronization, de-modulation, bit de-interleaving, packet de-framing, symbol decoding, and error correction of the particular modulation scheme. This data is then provided to the protocol processor 206 that provides the data in an output data format. For example, the data output format may be in a TCP/IP format or an ASCII based format suitable for use with an RS-232 link to a conventional oilfield SCADA system. Preferably, the receive DSP is a programmable DSP processor of the sort available from Texas Instruments, Analog Devices, and other manufacturers.

Please amend the paragraph on page 18, line 24, to page 20, line 11, as follows:

An important consideration in the design and implementation of the above described system is the impedance value at various points in the well bore. The impedance in the borehole of the

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well is a function of the frequency of the signal of interest and the depth of interest. The piping structure 111 and the casing 104 of the well form a coaxial transmission line that serves to conduct power and communications signals to and from the downhole module(s). For the illustrated embodiment, the annulus between the outer surface of the piping structure 111 and the inner surface of the casing 104 is filled with compressed air or another compressed gas. Thus, the relative dielectric constant of the coaxial structure is one and transverse electro-magnetic (TEM) propagation occurs at the free space velocity of light, approximately 1ns/ft. For a signal having a frequency such that the wavelength is less than one-tenth of the transmission line length, a simple lumped circuit model is accurate enough for design and implementation purposes. For a ten-thousand foot well, the one-tenth wavelength corresponds to a frequency of about 10 kHz. For a steel pipe used as the piping structure 111, the skin depth at 1 kHz is approximately 19 mils, at 60 Hz the skin depth is approximately 75 mils. Since the casing 104 and piping structure 111 are significantly thicker than this, calculations of the series impedance should include the surface impedance that arises from skin effect. At the lower frequencies of interest, the series resistance of the steel coaxial system is dominated by

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skin depth; also the series inductance arising from the skin effect can exceed the coaxial inductance, i.e., the inductance calculated based on the magnetic flux within the coaxial annulus. The skin effect impedance of the casing 104 and piping structure 111 can be calculated by first calculating the skin depth:

$$\delta = \sqrt{\frac{\rho}{\pi \cdot f \cdot \mu_0 \cdot \mu_r}} \qquad (1)$$

and then calculating the series resistance/unit length of the coaxial structure arising from the skin effect that is given by:

$$R_s = \sqrt{\frac{\rho \cdot f \cdot \mu_0 \cdot \mu_r}{\pi}}\left(\frac{1}{d_0} + \frac{1}{d_i}\right) \qquad (2)$$

The inductance inherent to the coaxial geometry bounded by the outer surface of the piping structure 111 and the inner surface of the casing 104 is given by:

$$L = 200 \ln\left(\frac{d_0}{d_i}\right)\frac{nH}{m} \qquad (3)$$

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and the capacitance is given by:

$$C = \frac{1}{18 \cdot \ln\left(\frac{d_o}{d_i}\right)} \frac{nF}{m} \qquad (4)$$

Where ρ is the resistivity of conductor, μ_0 is the permeability of free space, μ_r is the relative permeability of the conductor, f is the frequency of interest, d_0 is the inner diameter of the casing 104, and d_i is the outer diameter of the piping structure 111.

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